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VAGOTOMY IN THE TREATMENT OF PEPTIC ULCER*

(WITH AN ANALYSIS OF RESULTS IN ALMOST 650 CASES)

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DUODENAL ULCERATION is becoming an increasing economic problem. Not only does the rising stress of modern life lead to an increasing incidence of peptic ulcer, particularly in certain occupational groups, but it is also responsible for a similar failure rate from medical treatment. Partial gastrectomy, which for nearly 30 years has held sway as the surgical answer to this problem, has not proved the success originally anticipated. The tiny stomach remnant, which results from the radical resections employed for duodenal ulcer, is often incapable of carrying out its physiological functions adequately.

In spite of satisfactory surgical cures, a higher proportion of these patients than is generally recognized suffer from subsequent gastro-intestinal upsets. Careful review of the post-operative progress in any large series of cases will reveal that at least 40% have to remain permanently on a modified dietary regimen, and nearly 10% are unable to return to the occupations for which they were trained.

Though this may be a comparatively small price to pay for freedom from dangerous complications or possible malignant change in the case of medically resistant gastric lesions, it ought not to be necessary in chronic duodenal ulceration, which is not subject in the same degree to such hazards. Vagotomy, first introduced as a surgical success in Dragstedt's clinic in 1943, has supplied the solution.

FAILURES FOLLOWING VAGOTOMY

The rationale of this operation will not be discussed here. But I should like to stress a few points about this procedure that will explain why it has taken so long to attain its true place in gastro-intestinal surgery.

Over-enthusiasm for a new method of treatment resulted, in the early stages of its development, in many unsuitable cases being subjected to vagotomy. It was not uncommonly employed as the sole surgical procedure for gastric ulcer, in which it could not logically be of any benefit. Although the fact has never been stressed from the therapeutic viewpoint, gastric ulcers are always divisible clinically and pathologically into two main groups. In primary ulcers, which are never due essentially to excessive hyperacidity, there is no rational basis for employing vagotomy. Secondary gastric ulcers, which have developed as a complication of gastric retention, consequent on the pyloric stenosis or persistent pylorospasm of chronic duodenal ulcer, require more radical treatment. The only types of gastric ulcer in which vagotomy is of any real value are the very high lesions of the lesser curvature, provided that these are of relatively small size and not too long established. Such cases are notoriously resistant to medical treatment and the only surgical alternative to vagal section is an almost total gastrectomy. But, even in this type of ulcer, the beneficial results are probably due more to the physiological rest which the stomach enjoys after operation than to lowering of the gastric acidity. With this sole exception, vagotomy should never be carried out for gastric ulcer, unless the latter is also dealt with. By the time such lesions reach the surgeon, they are frequently in a chronic stage and often will not heal after vagal section alone, although most of the patient's symptoms may be relieved. Ulcer complications are therefore very likely to develop whilst both patient and his doctor are lulled into a false sense of security by their absence.

Even where the cases for this operation have been carefully screened, to exclude psychoneurotics and select only those suitable for it, incomplete vagotomy has been responsible for many poor results. While this is understandable during development of the operative technique, which takes considerable experience to perfect, there is no excuse for failing to recognize that it has occurred. It is obvious from studying the reports of such cases in the literature that most of them have been regarded as the normal end-results of vagotomy; whereas investigation by insulin test meal during postoperative convalescence, which has frequently been omitted, would at once have demonstrated the true state of affairs. Regeneration of the vagus is never to blame, for experience has shown that it does not occur if neurectomy has been complete. The

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vagus is a typical medullated nerve, and restoration of its function is virtually impossible if 2-3 centimetres are removed from each branch, particularly if the muscle barrier of the diaphragm is then interposed between the cut ends.

But by far the largest number of poor results after vagotomy have been due to lack of appreciation of the mechanism of sphincteric action in the bowel. Although the sympathetic and parasympathetic systems are mainly synergistic in their control of intestinal peristalsis, they are to some extent direct antagonists in sphincteric control. Particularly is this so at the pylorus, which bears the brunt of pressure from the strong, churning antral peristalsis. After vagal section, therefore, the unopposed sympathetic exerts its maximum effect at this site and the pyloric sphincter goes into gradually increasing spasm as muscle tone recovers. Gastric retention occurs and secondary hypertrophy of the stomach muscle follows, in an attempt to counteract the pyloric resistance, both these reaching their maximum intensity 9-18 months after operation. Such patients suffer from frequent belching of evil-smelling gas—the result of gastric fermentation—and may vomit food taken several days before. Pylorospasm causes pain very similar to that of the original duodenal ulcer, and the gastric distension may produce symptoms which mimic closely those of perforation. Heartburn and waterbrash are common, and even minor gastric hæmorrhage may occur; offensive diarrhœa results at intervals, as the fœtid stomach contents intermittently find their way through the spastic pylorus to cause irritation of the lower bowel. Large secondary gastric ulcers may develop unsuspectedly, their symptoms masked by those of the gastric retention.

My first 103 vagotomies, carried out in 1946-7, were all performed without any associated procedure to prevent this secondary retention, and 76 of these patients have since required further major surgery. Subsequent gastro-enterostomy was employed on 16 of them and partial pylorectomy on a further 48; whilst partial gastrectomy was necessary on no less than 12 cases that had developed secondary gastric ulcer— one of which showed early malignant change. Of the remaining 27 patients, only 13 have remained relatively symptom-free. The others all show mild retention symptoms which, though not yet serious enough to call for further operation, may demand it later.

Development of Associated Partial Pylorectomy

It was results such as these—the normal sequelæ of complete vagotomy—which did much to give the operation its undeservedly bad reputation, within two years of being hailed as the dawn of a new era in ulcer surgery. If vagal section was to be of any value, it became evident that some additional procedure would have to be employed, to prevent this subsequent retention syndrome. Encouragement to pursue this aim was given by the discovery that subsequent laparotomy on these cases showed healing of the original duodenal ulcer in every instance, despite the appalling clinical results.

It was soon found that associated sympathectomy of the pyloric area, in an attempt to prevent later pylorospasm, was an impossible surgical feat; and that the solution of this problem would have to be some mechanical manœuvre, designed either to defunction the pylorus or to by-pass it. The majority of surgeons have adopted associated gastro-enterostomy as the solution but I felt that an attack on the spastic pylorus itself would be more logical, as well as producing a more physiological end-result, and therefore carried out experimental work in this direction. I found that simple pyloroplasty was extremely difficult technically, in the presence of gross deformity of the duodenal cap, and that subsequent scarring often partially obliterated the stoma. Partial pylorectomy, however, with resection of at least the anterior half of the pyloric sphincter and a subsequent pyloroplasty of the Judd type, was found to give excellent results and I have employed it routinely over the past six years. Only very rarely has it been necessary to substitute gastro-enterostomy, where there was exceptional fixation of the duodenum or the patient's obesity prevented good access to it.

Partial pylorectomy has several other important advantages over gastro-enterostomy, besides reconstituting the natural food pathway along the bowel. Unless the latter is carried out at the pyloric antrum, often a difficult technical feat, the distal portion of the stomach beyond the stoma not infrequently gives rise to unpleasant postoperative symptoms. Unlike gastro-enterostomy for pyloric stenosis, in which the block is entirely mechanical, the cause of the obstruction in this case is mainly myogenic in nature and the presence of a by-pass does not

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therefore have the same effect. Vigorous peristalsis of the pyloric antrum, still continuing to work against the muscle spasm of the pylorus, can produce considerable postprandial discomfort after a heavy meal. But the great advantage of partial pylorectomy is that it gives direct access to the early duodenum, and thus permits full examination of the pathological area. Not only can all anterior ulcers, excessive scar tissue and redundant duodenal pouching be readily removed, but any posterior ulceration can also be dealt with by exclusion or excision. The bowel can thus be restored to a relatively normal condition. This approach also allows digital exploration of the whole stomach and of the duodenum as far as the ampulla of Vater and, incidentally, provides the only really practicable access to a bleeding duodenal ulcer.

Other operations, which have been devised to overcome the problem of secondary pylorospasm, are total pylorectomy with subsequent gastro-duodenostomy along the lines of a Billroth I gastrectomy, or an associated partial gastrectomy of the Polya type. Neither of these is satisfactory. The former is a most difficult, and often an impossible, procedure in the presence of gross duodenal deformity, whilst the latter operation has several disadvantages. Besides involving the additional operative risks attendant on gastrectomy, it leads to the removal of most of the mucosa responsible for the hormonal phase of gastric secretion. This must produce a considerable reduction in the digestive powers of the stomach—the avoidance of which constitutes one of the major advantages of vagotomy and, indeed, was the main reason for its development. Associated partial gastrectomy is therefore an unnecessarily mutilating operation from anatomical and physiological viewpoints.

But, whatever method is employed to prevent later gastric retention, the vagotomy itself should always be carried out through an abdominal approach, except in particular instances where this is definitely contraindicated. Complete neurectomy is much less likely to be achieved by the transthoracic route, since it is only at the level of the diaphragm that the vagus plexus consistently coalesces to form definite nerve trunks. Moreover, transthoracic vagotomy does not permit of any associated procedure to prevent later gastric retention, unless the abdomen is also opened through the diaphragm; nor does it allow inspection of the abdominal lesion, without which one cannot be certain that some concurrent lesion is not being overlooked. Lastly, there is no comparison between the convalescence from a thoracic operation and the much shorter and smoother recovery following abdominal vagotomy.

THE RESULTS OF VAGOTOMY

The end-results of vagotomy, when combined with some associated procedure to prevent the otherwise inevitable retention syndrome, are extremely satisfactory. The initial psychic phase of gastric secretion is abolished and, with it, the dangerous, highly acid, fasting juice which is the main factor in the production of chronic duodenal ulcer. The acidity of the secondary hormonal stage of gastric digestion is also reduced to about a third of the normal, though it still remains adequate for all ordinary purposes. The total acidity is thus reduced to within harmless limits just as effectively as by gastrectomy, yet the patient is left with a relatively normal and physiological gastro-intestinal tract. The duodenal ulcer itself, even if not excised, almost always heals spontaneously. Recurrent ulceration is extremely rare if vagotomy has been complete—only one proven case of it occurring in my own series of 643 operations, all of which have been followed up carefully for up to eight years. It was suspected on three other occasions but, in each instance, an insulin test meal showed evidence of incomplete neurectomy, and subsequent laparotomy showed the presence of a large intact vagal branch, which had been missed at the original operation.

Temporary ileus of the stomach, duodenum and small bowel always occurs after vagotomy, and lasts for 72-96 hours, but it is rarely severe enough to necessitate gastric suction or prolonged intravenous therapy, and most patients can be started on a rapidly-increasing diet within 24 hours of operation. A period of diarrhœa not infrequently follows the termination of this ileus, and may last as long as 10-14 days. It was present, in some degree, in 11.4% of my cases but was never incapacitating. Temporary dysphagia occurred in 15.2% of patients, within the first three weeks of convalescence. This is probably due to partial achalasia of the lower œsophagus, the result of division of the vagal supply to it. However, it is neither complete nor continuous and passes off spontaneously within a week or two, and there have never been any

undesirable sequelæ attributable to this source. Within three months of operation, the whole gastro-intestinal tract has apparently settled down completely to normal, save that the bowels are more regular and softer than before and that a minority of patients—2.8% in my series—suffer from occasional mild flatulence after a heavy meal. But it seems probable that this does not greatly exceed the incidence of the occasional indigestion experienced by normal persons after such dietary indiscretions.

The only other unpleasant symptoms which may follow vagotomy with some associated procedure to prevent gastric retention are those of hypoglycæmia. This developed in 8.7% of my cases, though it was only incapacitating to any degree in four instances. The attacks come on shortly after food and are quite typical, patients sometimes volunteering that their sensations are identical with those previously experienced during the deliberate hypoglycæmia induced by an insulin test meal. However, they rarely last for more than a few minutes even if uncontrolled, and are readily and rapidly terminated by the ingestion of glucose. These attacks are very similar to those which may follow gastrectomy but are not related to the speed of stomach emptying, their incidence being approximately the same in the normally-emptying stomach following vagotomy plus partial pylorectomy as in cases of gastric retention after vagotomy alone. The exact mechanism of this symptom-complex is still uncertain but there seems little doubt that it is due to some upset of glucose metabolism resulting from division of the vagal supply to the liver and pancreas. However, the symptoms are usually so mild as to pass unremarked by the patient unless he is specifically questioned on the subject; and they diminish rapidly in both frequency and intensity, disappearing completely within two years in even the severest of cases.

Before my patients leave the hospital, usually on the 10th to 12th postoperative day, they are on full, regular meals and they are not restricted thereafter, except that spirits, condiments and smoking are limited up to the time of their first postoperative review three months later. There is therefore much better adjustment to both environment and work conditions than is obtained after gastrectomy, when a continued modified dietary regimen is so often necessary. Gain in weight is rapid—the average in my own cases being 12.9 pounds in the first three months—and most patients are back at their previous occupations well within this period. No less than 90.6% of my patients have been relieved permanently of all symptoms within 10 weeks of operation; another 5.2% have been restored to normal social and economic life three months after vagotomy, though still liable to minor attacks of indigestion or hypoglycæmia for a further 6-18 months. Thus only 4.2% of the total have had to be regarded as incomplete successes, due either to subsequent failure to re-adjust to life or to the persistence of mild gastro-intestinal symptoms for more than two years postoperatively, though all but one of these have been surgical cures so far as the duodenal ulceration was concerned.

Vagotomy, with an associated gastric drainage operation, possesses two further advantages over gastrectomy. It is a much shorter procedure, taking less than half the time necessary for a gastric resection; and it has a considerably lower mortality rate. I have had three deaths in my series of cases, two of them due to early imperfections of technique and the third to postoperative pneumonia, so that the overall mortality rate is 0.47%, though nil over my last 460 operations.

In addition to its value in the treatment of the high, lesser-curvature gastric ulcers already mentioned, vagal section is also a most useful operation for secondary peptic ulceration following inadequate gastrectomy or ill-advised gastro-enterostomy. Alternative operations to deal with this unfortunate complication are lengthy, often difficult, and carry a high operative mortality rate. Simple vagotomy, without any other associated procedure, has given equal success in over 92% of such cases from my own series, the reduction in acidity and the relief of secondary spasm allowing the ulcer to heal spontaneously.

CONCLUSION

In conclusion, it is fair to say that vagotomy has now been shown to be the operation of choice for chronic duodenal ulcer, and to be of very considerable value in certain other types of ulceration. The original enthusiasm with which this operation was greeted has proved entirely justified, and its excellent long-term results fully warrant the increasing recognition it is gaining in the surgery of peptic ulcer.

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